Aqueous dye-sensitized solar cells: challenges in electrodes and electrolytes design

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Dye sensitized solar cells (DSSCs) are not yet commercialized on large scale due to their issues concerning safety and long-term stability. In fact, standard high-efficiency DSSCs are prepared mainly with organic solvent-based liquid electrolytes, *i.e.* acetonitrile and methoxypropionitrile, and are often characterized by high vapor pressure, toxicity and flammability. In recent years, with the idea of creating efficient, safe, and low-cost DSSCs, the research moved the attention towards alternative solvent-based electrolytes. Above all, DSSCs with water-based electrolytes look like one of the best solution providing reduced costs, nonflammability, better stability, and environmental compatibility. Moreover, the possibility of gelling the liquid solvent into a polymeric matrix can reduce the electrolyte leakage outside the device, increasing the long-term stability.
In this contribution, the investigation on a series of iodine/cobalt-based 100% aqueous electrolytes is presented. In parallel, photoanode preparation and sensitization is studied to achieve the best electrode/electrolyte interfaces. Finally, the gelation of aqueous electrolytes with bio-derived polymers is presented, leading to lab-scale devices stable for several months.

References: Chem. Sci. 7 (2016) 4880-4890; Green Chem. 19 (2017) 1043-1051; Energy Tech. 5 (2017) 300-311; Chem. Soc. Rev. 44 (2015) 3431-3473.

Claudia Barolo received her PhD in Chemistry from Università di Torino in 2001. In 2006, she became assistant professor and, in 2014, associate professor in Industrial Chemistry at the Department of Chemistry of the same university. Her research activity is mainly focused on the synthesis and characterization of functional molecules and hybrid materials for technological applications (photovoltaics, nanotechnology, biotechnology). As an expert in the field of sensitizers for solar cells, she is the recipient of several national and international research grants and industrial collaborations. She has published more than 80 ISI articles.